November 25, 1977

Memo to File:

Re: Kaiser Aluminum & Chemical Corp.
ACT/045/002

I have reviewed the recently completed U.S.G.S. report on the hydrology of the Bonneville Salt Flats and have the following comments.

The Salt Crust on the Bonneville Flats has been shown to be in a delicate dynamic balance, the extent and thickness of the crust depending upon the following factors:

1. Direct precipitation which infiltrates rapidly through the crust tends to seasonally (fall-spring) dissolve the crust and recharge the near surface brine. Observations at nearby Pilot Valley have shown a natural decrease in the areal extent of the crust during the 60's and early 70's. This salt is now in solution in the near surface brine which is available for re-precipitation via evaporation. In the Bonneville Playa, this brine is being removed via ditches to the salt plant.

2. Evaporation through the playa surface is the largest source of discharge from the shallow brine aquifer. Where the evaporation of brine exceeds the recharge through the surface, the salt crust is thickened and vice versa. The salt crust is divided into two areas; one is a perennial (1-3') salt crust and; one is a seasonal (0.25-1.5") crust which fringes the perennial crust. Drawdown of the potential surface of the shallow brine aquifer decreases the amount of surface evaporation.

3. Wet season precipitation often cannot infiltrate fast enough and stands on the crust up to 6" deep. This brine is pushed in floods over the playa generally toward the southeast. It is also a source of salt to the crust as it evaporates and tends to naturally smooth the crust as opposed to the evaporation of the shallow brine aquifer which roughens the surface. The floods also move detrital sediment over the salt crust from the fringing sulfate and carbonate mud flats.

4. Water from the nearby alluvial fans naturally recharges the playa; some goes into near surface horizons and some goes to deeper zones which are not hydraulically connected to the shallower zones. This alluvial fan aquifer is normally artesian and is shown to respond very rapidly to seasonal weather changes.

The report has documented a number of man-made effects on the playa. They are as follows:

1. Brine extraction from the alluvial fans to the west of the salt crust

between 1946-1965 destroyed the artesian aquifer there by drawing down the water level 20-40'. This caused a reversal of the playa potentiometric surface to the west so that brine now flows from the playa toward the alluvial fans. In 1976, Kaiser was pumping four wells for brine.

2. Seasonal and long term changes in the near surface brine aquifer have been shown to exist due to brine removal via the ditch network. The potentiometric surface shows long term flow to the east and south. The effects of this have been shown to be:

a. A decrease in the areal extent of the seasonal and perennial salt crust south of I-80 which has exposed to wind erosion areas of sulfate mud.

b. A general lowering of the potential surface as opposed to a general lifting of the potential surface in Pilot Valley.

c. A reversal of the dominant vertical water movement through the crust from upward to downward.

d. A decrease in the total volume of dissolved salt in the shallow brine which is available for re-precipitation.

e. The movement of normally northwest flowing brine is intercepted south of I-80 in the ditches and prevented from being deposited at the crust north of I-80.

3. The brine flow to the alluvial fans west of the playa has combined with the flow to the ditches in producing an artificial ground water divide which was locted between the race track and the ditch network north of I-80. This shows that subsurface brine below the track was not flowing toward the ditches during 1976.

4. Ditches have effected the movement and deposition of salt and sediments from the surface brine floods. The north ditch network collects and drains floods in the track area so that this salt is lost from the track area. Ditches to the southeast of the track have their spoil piles to the windward and these act as barriers to flood flow and prevent the widespread flow of same. This causes concentration of detrital sediment on the salt crust which tends to destroy the smooth crust.

Remedial measures to save the salt crust should include the removal of surface drainage barriers; the cessation brine collection or the installation of subsurface barriers in strategic locations; replacing the leftover halite now sitting in abandoned evaporation ponds. These remedies of course would not fit into Kaiser's operation plan. However, if Kaiser were to move its collection system so that all brine collection would be south of the railroad, this would stabilize the deterioration of the track. The regrading of the abandoned arcuate collection system southeast of the track would prevent the present sediment problem there. The present I-80 embankment is an effective barrier to the southward flow of surface brine from north of the highway. This must help the track conditions.

The most important point as far as the reclamation plan is concerned is that abandoned ditches and ponds must be regraded to prevent degredation of the crust for a long time after cessation of operations.

BRIAN W. BUCK
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